

TERMITOPHILOUS APTERYGOTA
FROM BRITISH GUIANA*

By JUSTUS W. FOLSOM.

University of Illinois.

(Plates XVIII-XXIII).

The material upon which this report is based was collected at the Tropical Research Station of the New York Zoological Society, Kartabo, British Guiana, in 1919 and 1920 by Mr. Alfred Emerson.

The following six species are described, all of which are new, and one of which represents a new genus of Collembola.

THYSANURA: *Atelura guiana*, *A. lepismoidea*, *A. crispula*, *A. cucullata*, *Nicoletia emersoni*. COLLEMBOLA: *Borecus pin-natus*.

Types of these have been deposited with the New York Zoological Society.

All these forms except the *Nicoletia* are termitophilous. The genus *Atelura*, in particular, is strictly myrmecophilous or termitophilous, and it is appropriate here to bring together the little that has been published on the habits of this genus. Additional observations made by Mr. Emerson, appear beyond.

HABITS OF ATELURA

The statement of Escherich ('04) that all the species of *Atelura* are either myrmecophilous or termitophilous is probably still true. Of twenty-four species that I have found recorded up to the present eighteen are myrmecophilous or termitophilous, as are doubtless also the remaining six (from Africa and Australia), descriptions of which I have not seen.

According to the observations of Janet ('96a, '96b) on *Atelura formicaria* Heyd. in a nest of *Lasius umbratus* Nyl.,

* Tropical Research Station, Contribution Number 139.

the *Atelura* can get along without the ants provided it has available an appropriate nourishment; but is attracted to the nests of ants by the nutritive fluid that the ants disgorge and feed to each other. As a pair of ants stand mouth to mouth, absorbed in the process of feeding, the *Atelura* rushes in, grabs the drop of food and hurries away. This performance is repeated with other pairs of ants until the hunger of the *Atelura* is satisfied. The guests are tolerated by their hosts for the good reason that by their agility they are usually able to elude the ants, but these interlopers are constantly being chased by their victims, and are sometimes caught and killed.

In regard to the Brazilian species *Atelura termitobia* Silv., Silvestri ('01a) gives the following observations.

"In the royal chamber of *Anoplotermes tenebrosus* I found with the king and queen . . . three examples of *Grassiella* [*Atelura*], which were running about unmolested among the workers. I placed the royal pair, some workers and the three individuals of *Grassiella* together in a glass tube and observed that the last-named lived in perfect harmony with the termites, without at any time being pursued by them. Once I saw a *Grassiella* on the back of a queen, while the head of a worker, which had just cleaned the latter, was quite near the head of the *Grassiella*. Perhaps these thysanurans also steal food from the termites, as others do from ants."

Silvestri ('01a) observed the minute Brazilian species *Atelura synoeketa* Silv. in the nests of *Eutermes microsoma* Silv., and says concerning them: "In the galleries of *Eutermes* I saw three individuals of *Grassiella* [*Atelura*] rambling around in the midst of the workers, soldiers and larvae, which I captured and placed alive in a glass tube, together with their hosts. They walked about everywhere among the termites, sometimes encountering them head to head without, however, either species making the slightest impression upon the other. I saw also a *Grassiella* enter a gallery in which there were *Eutermes* and emerge from the other side unharmed. Never did I see a *Eutermes* pursue a *Grassiella*, or vice versa."

Thus the species of *Atelura* get food and shelter in the nests of ants and termites, but the benefit is one-sided, for the hosts gain nothing from the association with their guests.

The species of *Atelura* are not usually limited to a single species of host, but most of them occur with a number of different species of ants and termites.

In distribution the genus is widespread, occurring in all the faunal realms. The species are small, as a rule, attaining at most a length of six or seven millimeters.

Mr. Emerson says, in regard to the species of *Atelura* in the nests of termites: "In all cases they seemed to be ignored by the termites. They moved swiftly about among the termites, resting very little. In no case did I observe any hostile actions toward them on the part of the termites. I observed *Atelura lepismoidea* n. sp. several times running about, closely following worker termites (*Nasutitermes* (*N.*) *acajutlae* Holmgren) but did not happen to see them obtain regurgitated food or abdominal secretions from the termites, although it is very possible that at times they obtain food in this way. They seem to be pantermitophilous, as shown by the list of the host species in whose nests they were found."

Atelura guiana sp. nov.

(Plate XVIII, figs. 1 to 11).

General color golden yellow, due to the scales; body color yellowish white. Appendages white except in large specimens, in which the antennae, bases of the legs, and of the pseudocercus ("median cercus") may be brownish yellow. Small individuals are yellowish white throughout. Form subelliptical (fig. 1), broadest across the mesothorax, with width to length as 1:2.5. Thorax five-eighths as long as the abdomen. Abdomen smoothly confluent with the thorax in outline. Body strongly arched. Thoracic terga with rounded lateral borders, projecting far down over the bases of the legs. Antennae (fig. 2) short, about nine-tenths as long as the thorax, or less than one-third the total length, with usually 12 segments, and occa-

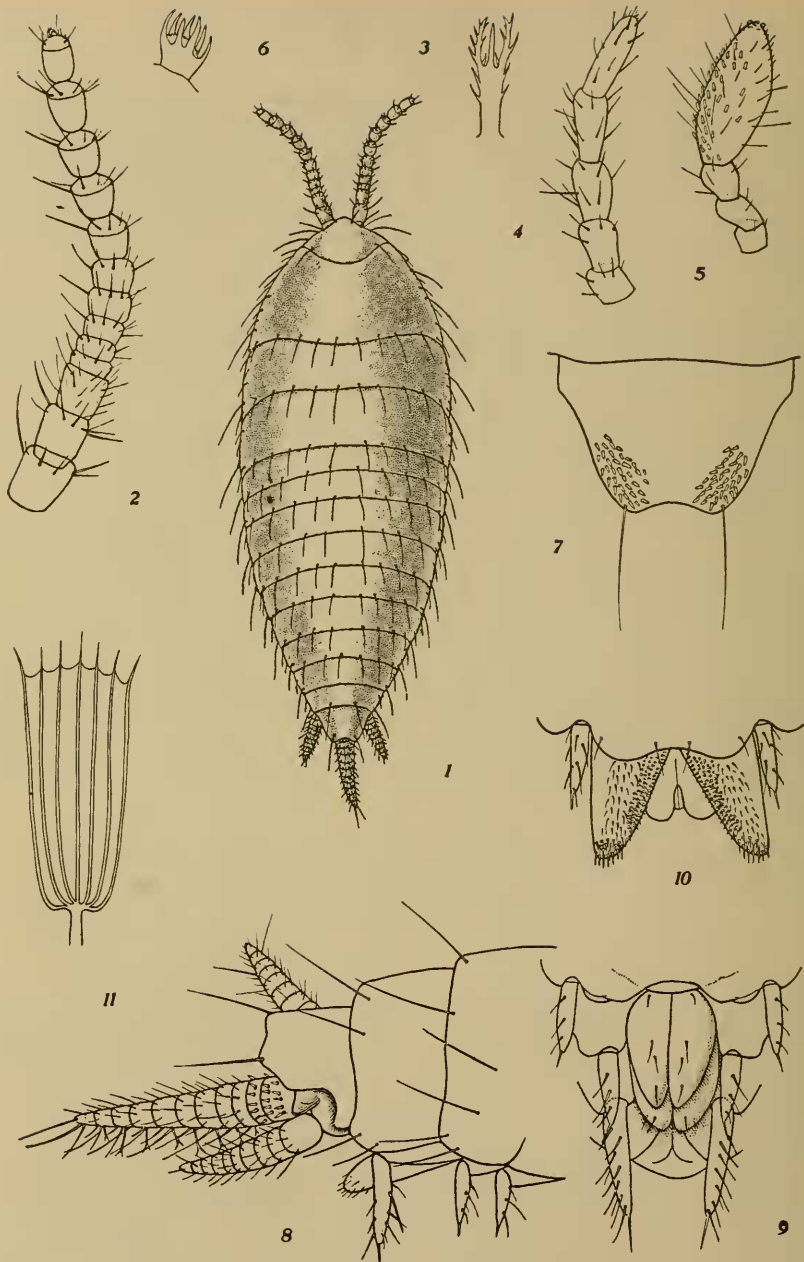


Plate XVIII. *ATELURA GUIANA* SP. NOV.

1, dorsal aspect, X 25; 2, antenna, X 66; 3, terminal sense organ of antenna, female, X 790; 4, maxillary palpus, X 86; 5, labial palpus, male, X 96; 6, sense organ from labial palpus, X 790; 7, tenth urotergite of male, dorsal aspect; the pegs are ventral in position, X 86; 8, extremity of abdomen of male, to show cerci and styli; the lower cercus in the figure is displaced, X 68; 9, ovipositor and styli, ventral aspect, X 85; 10, parameres and penis, ventral aspect, X 85; 11, typical scale from dorsum, X 505.

sionally 11 or 13; distally moniliform; last five segments each with a distal subsegment; apical segment oblong-elliptical, with length to width as 9:5 or 5:3; the three or four segments immediately preceding the apical segment subovate to subglobose; apical segment with a terminal branched sensory organ (fig. 3); second segment in male without a secondary sexual process, but with a ventral circular radiate sense organ. Maxillary palpi (fig. 4) with segments in relative lengths as 8:15:16:18:25; last segment elliptico-cylindrical. Labial palpi (fig. 5) with segments as 6:12:10:40; last segment elliptical, twice as long as broad, with sensory pegs and an apical cluster of six branching sensory papillae of the type shown in fig. 6. Tenth abdominal tergite (fig. 7) with a shallow emargination in both sexes; distal lobes each with about 35 ventral pegs in the male only. Cerci (fig. 8) short; lateral cerci with about 10 segments (9-12); pseudocercus ("median cercus") one and one-half times as long as the lateral cerci, with about ten segments (10-12), and with short dorsal pegs on the proximal two segments in the male. Styli (figs. 8, 9) three pairs, on the 7th to 9th abdominal segments, respectively. Dorsal valves of ovipositor (fig. 9) longer than the ventral; ventral valves semi-ovate in ventral aspect, unsegmented. Parameres of male (fig. 10) in ventral aspect subtriangular, blunt, divergent, armed apically with short spines, and mesally with many short hooks. Body segments with dorsal rows of long outstanding hairs, mostly along the posterior border of each segment. Dorsum of head with several short hairs, apically bifurcate. Dorsal scales dense, varying in form and size, but typically as in fig. 11. Maximum length, 3.7 mm.

This species is near the Brazilian *Atelura* (*Grassiella*) *synoeketa* Silvestri ('01a, '01b) in which, however, the body is anteriorly oval, the antennae ten-segmented and one-third as long as the body, and the latter only 1.6 mm. in length.

Twenty-eight specimens, Kartabo, Bartica District, British Guiana, June 30, July 20, 27, 28, August 11, 20, 21, October 11, 15, November 4; Barakara, Bartica District, July 15. (Field Nos. 91, 108, 151, 208, 236A, 242, 248, 274, 403, 426, 476.)

Atelura guiana occurred in the nests of the following species of termites: *Nasutitermes* (*N.*) *guyanae* (Holmgren), *ephratae* (Holmgren), *octopilis* Banks, *surinamensis* (Holmgren); *Nasutitermes* (*Angularitermes*) *nasutissimus* n. subg. n. sp.; *Anoplotermes* (*A.*) sp. (No. 151); *Mirotermes* (*Cavitermes*) *tuberosus* n. subg. n. sp. All these species build conspicuous, well formed nests above the ground with the exception of *N. octopilis* and *N. nasutissimus*, which have rather loosely constructed nests.

***Atelura lepismoidea* sp. nov.**

(Plate XIX, figs. 12 to 20).

Pale, yellow; appendages white. Body (fig. 12) two-fifths as broad as long, somewhat lepismiform, broadest across the metathorax, not strongly arched. Abdomen confluent with thorax, about 1.4 times as long as thorax, tapering in dorsal aspect, with lateral outlines straight or slightly concave. Thoracic terga rounded laterally and covering the bases of the legs. Head rounded in front. Antennae (fig. 13) as long as the head plus the thorax, with 15, occasionally 16, segments, of which all but the first 6 are subsegmented, segments 7 and 8 each having two subsegments, and segments 9-15 having three; first 6 segments in relative lengths about as 19:17:8:4:5:10; distal segments elongate, elliptical; last segment more than twice as long as broad, with a terminal sensory organ of the type shown in fig. 3; second segment in male without a secondary sexual process. Maxillary palpus (fig. 14) with segments as 13:17:19:22:32; last segment narrowly subelliptical, three times as long as broad, with a single apical branching sensory papilla. Labial palpus (fig. 15) with segments as 9:10:21:46; last segment elliptical, twice as long as broad, with an apical cluster of six sensory papillae of the type shown in fig. 6. Tenth abdominal tergite with a median rounded emargination, deep in the male (fig. 16) and shallow in the female (fig. 17); posterior lobes each with about 20 (17-21), ventral cones or pegs (fig. 16) in the male only. Cerci short; pseudocercus ("median cercus") with ten segments, the proximal two segments bearing a few dorsal pegs in the male (fig. 16), usually four pairs, becoming successively longer;

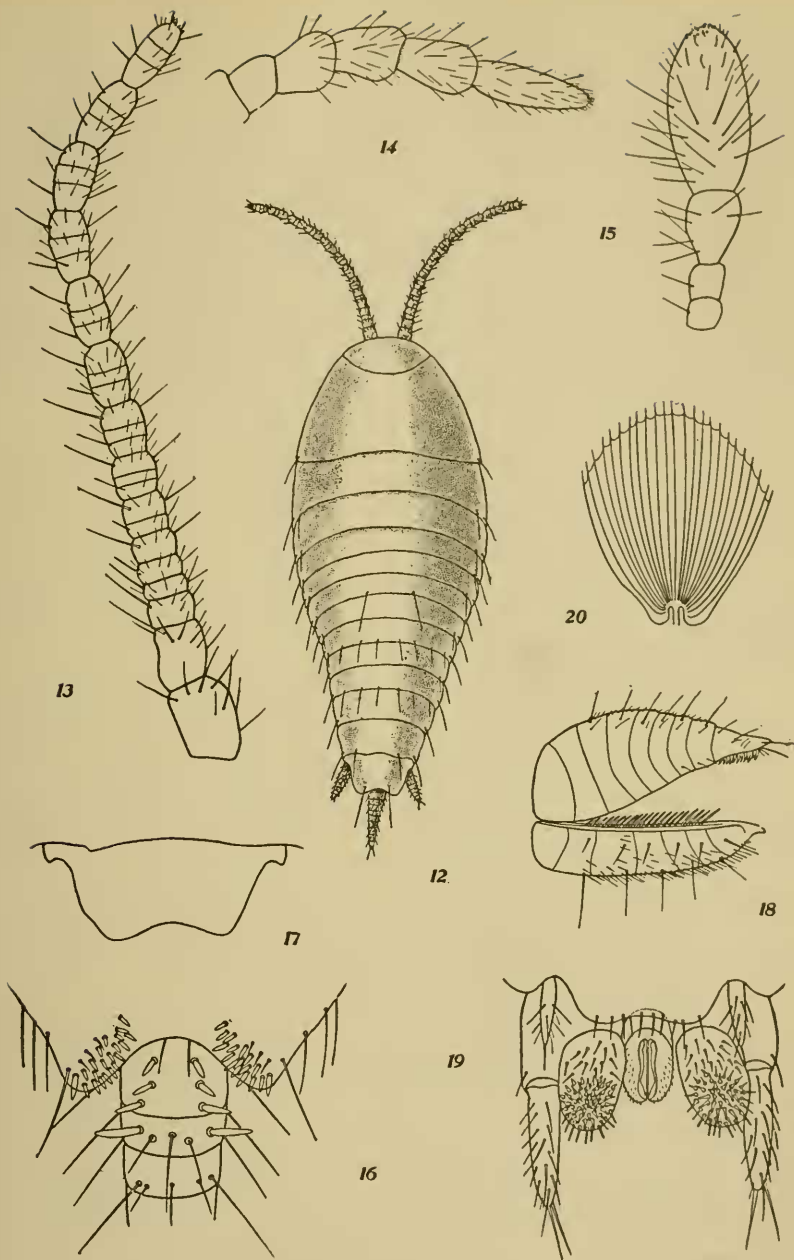


Plate XIX.

ATELURA LEPISMOIDEA SP. NOV.

12, dorsal aspect, X 25; 13, antenna, X 86; 14, maxillary palpus, X 100; 15, labial palpus, X 100; 16, dorsal aspect of extremity of tenth urotergite and base of pseudocercus of male; the pegs of the former are ventral in position, X 175; 17, tenth urotergite of female, X 86; 18, left aspect of ovipositor, X 53; 19, parameres and penis, ventral aspect, X 86; 20, typical scale from dorsum, X 505.

lateral cerci five-sixths as long as the pseudocercus, with 8-10 segments. Styli four pairs, on the 6th to 9th abdominal segments respectively. Ovipositor extending as far as, or slightly beyond the lateral cerci, with both pairs of valves segmented (fig. 18), the ventral valves smaller and slightly shorter than the dorsal. Parameres of male stout, subcylindrical (fig. 19), apically armed with many stiff spines. The long stiff dorsal hairs of the body are limited to the posterior borders of the segments; there are possibly more of these than are shown in fig. 12. Dorsal scales typically as in fig. 20, though varying in form and size. Length, 3.2 mm.

The usual number of antennal segments is 15 in both sexes, but one female had 16, and small specimens (1.7 mm. in length) had only 12, 13 or 14.

Forty-one specimens, Kartabo, Bartica District, British Guiana, July 13, 20, August 7, 18, 21, September 21. (Field Nos. 100, 197, 225, 242, 248, 339.)

Atelura lepismoidea had as hosts these five species of termites: *Nasutitermes* (*N.*) *surinamensis* (Holmgren), *costalis* (Holmgren), *acajutlae* (Holmgren), *ephratae* (Holmgren); *Armitermes* (*N.*) *teevani* n. sp. These build conspicuous, well formed nests above the ground, with the exception of *A. teevani*, the nest of which is usually on the ground.

Atelura crispula sp. nov.

(Plate XX, figs. 21 to 30).

Pale yellow; appendages white. Broadly elliptical (fig. 21); length to breadth as 1.8:1; body strongly arched, reminding one of a "sow-bug"; abdomen smoothly confluent with the thorax in outline, twice as long as the latter. Lateral borders of thoracic terga rounded, extending down over the legs. Antennae short, about as long as the thorax, or about one-third the entire length, with 14 or 15 segments, of which the last 6 or 8 have each two subsegments (fig. 22); last segment elliptical, twice as long as broad, with a terminal branched sensory organ (fig. 23). Maxillary palpi (fig. 24) with segments in relative lengths as 8:12:16:17:20; last segment elongate-conical.

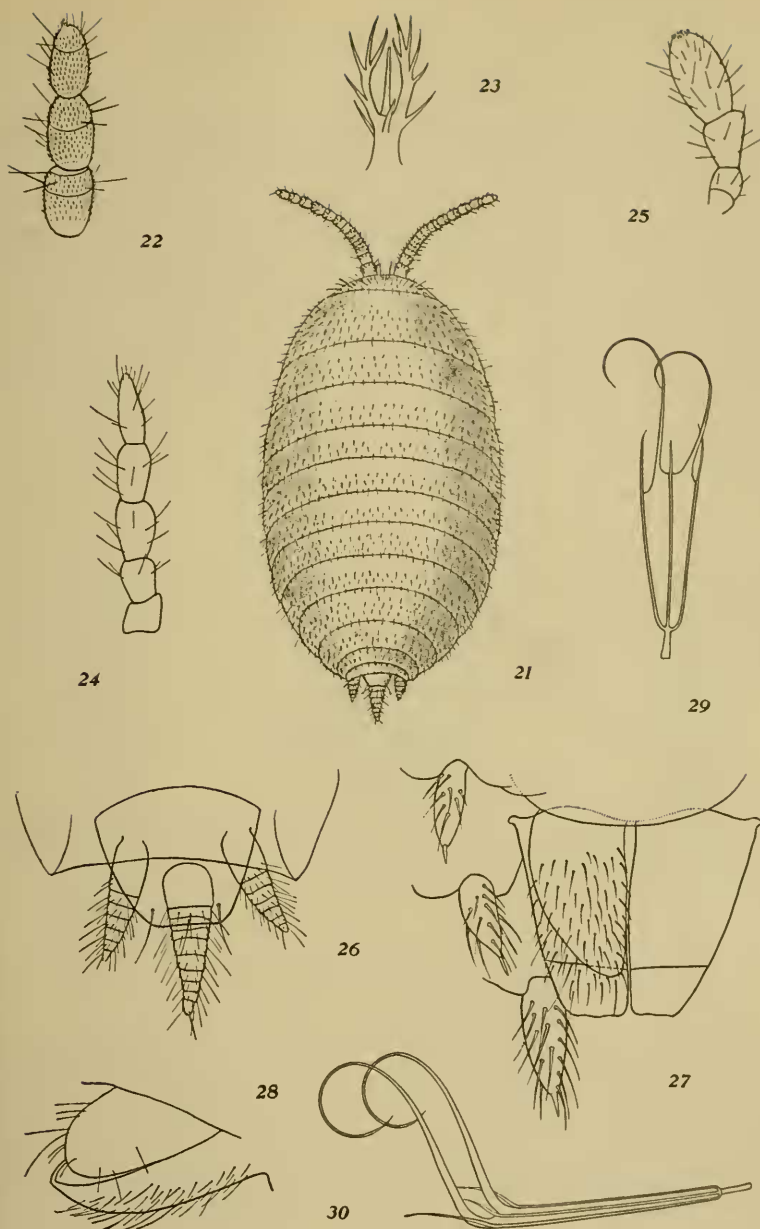


Plate XX.

ATELURA CRISPULA SP. NOV.

21, dorsal aspect, X 25; 22, last three segments of antenna, X 110; 23, terminal sensory organ of antenna, X 790; 24, maxillary palpus, X 86; 25, labial palpus, X 86; 26, tenth urotergite, cerci and pseudocercus of female, X 53; 27, ovipositor and styli of right side, ventral aspect, X 85; 28, right aspect of ovipositor, X 86; 29, dorsal aspect of scale from dorsum, X 505; 30, lateral aspect of scale from dorsum, X 959.

Labial palpi (fig. 25) with segments as 5:7:14:26; last segment elliptical, twice as long as broad, with six branching sensory papillae near the apex. Tenth abdominal tergite subtrapezoidal (fig. 26), with posterior margin entire (feebly emarginate in one specimen) and with postero-lateral borders rounded. Cerci short and stout (fig. 26); pseudocercus ("median cercus") one-fifth longer than the lateral cerci, 10- or 11-segmented; lateral cerci 7- or 8-segmented. Posterior abdominal segments short, bringing the styli close together. Styli three pairs, short and stout (fig. 27), on the 7th to 9th abdominal segments, respectively. Ovipositor short and stout (fig. 28), the ventral valves exceeding the dorsal; dorsal valves short and stout, rounded apically; ventral valves in ventral aspect suboblong, apically truncate, with a subapical transverse suture (fig. 27). Most of the hairs of the body are dense, short and stiff; long suberect hairs occurring on the head. Most of the scales, which clothe the dorsum densely, are of the peculiar and characteristic form shown in figs. 29 and 30, each scale having a pair of long curling branches. Length 2.3 mm.

Six specimens, all females, Kartabo, Bartica District, British Guiana, August 4, 1920 (No. 182).

Atelura crispula had as host *Armitermes* (*A.*) *percutiens* n. sp., which builds a fairly well constructed dirt nest on the ground or very close to the ground.

Atelura cucullata sp. nov.

(Plate XXI, figs. 31 to 39).

Golden yellow; appendages white, with pseudocercus brownish basally. Form elliptical (fig. 31), twice as long as broad, thorax to abdomen in length as 5:9. Abdomen smoothly confluent with thorax in dorsal aspect. Body strongly arched, as in a "sow-bug". Thoracic terga projecting down over the bases of the legs.

Antennae (fig. 32) short and stout, one-tenth the length of the body, 13-segmented, without subsegments; last segment ovate, the three preceding segments cup-shaped, about as broad as long. Maxillary palpi (fig. 33) with segments as 1:3:3:4:5;

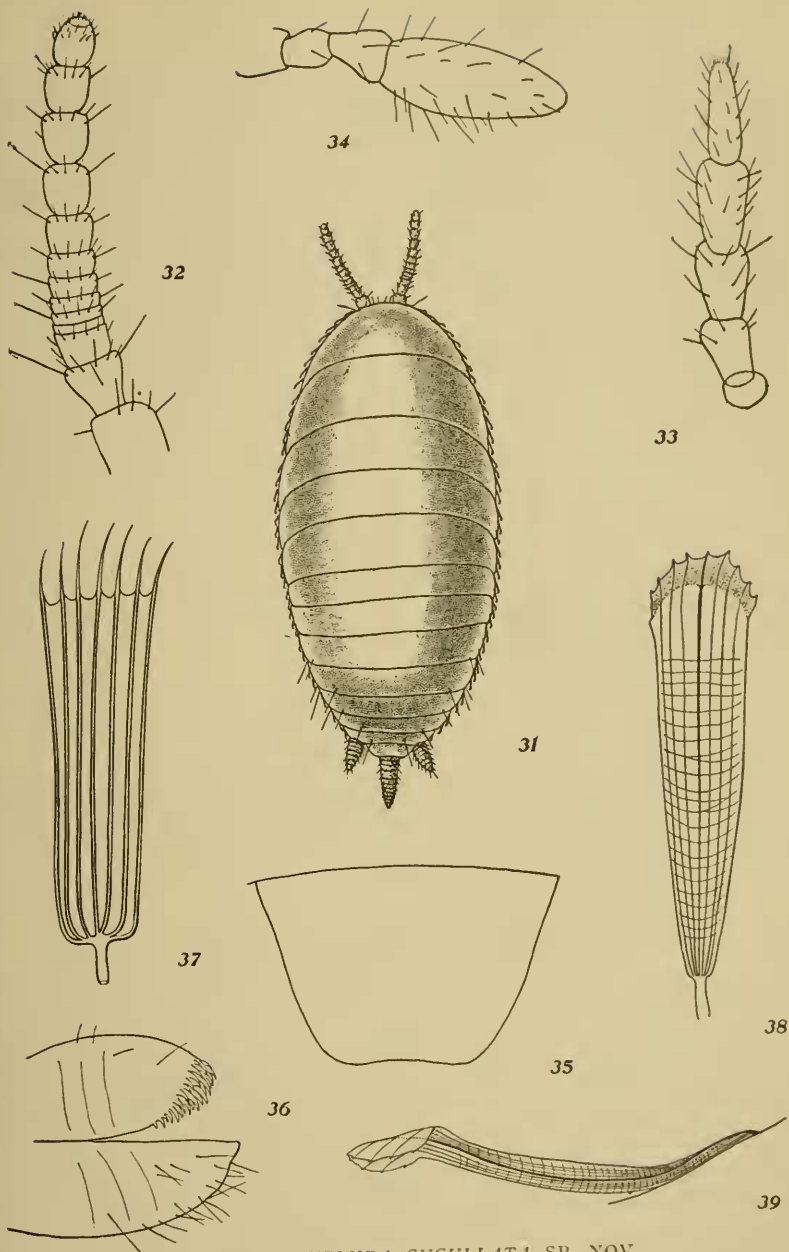


Plate XXI. *ATELURA CUCULLATA* SP. NOV.

31, dorsal aspect, X 17; 32, antenna, X 68; 33, maxillary palpus, X 85; 34, labial palpus, X 85; 35, tenth urotergite of female, X 85; 36, left aspect of ovipositor, X 86; 37, typical unmodified scale from dorsum, X 505; 38, modified scale from dorsum, dorsal aspect, X 505; 39, Modified scale from dorsum, lateral aspect, X 505.

last segment subconical, three times as long as broad. Labial palpi (fig. 34) with fourth segment three times as long as the third and lanceolate-elliptical, with length to breadth as 5:2. Tenth abdominal tergite (fig. 35) trapezoidal, with posterior border feebly emarginate and postero-lateral angles broadly rounded. Cerci short and stout; lateral cerci 8-segmented; pseudocercus ("median cercus") twice as long as the lateral cerci, 11-segmented. Posterior abdominal segments short, bringing the styli close together. Styli three pairs, on 7th to 9th abdominal segments, respectively. Ovipositor (fig. 36) with the ventral valves longer than the dorsal; both pairs segmented; dorsal valves with a terminal cluster of hooks. Dorsum of body without hairs, excepting a few stiff lateral hairs on the posterior abdominal segments (fig. 31). Dorsal scales dense, there being in each transverse series two types of scales, alternating with each other in position: the simple type shown in fig. 37 and a peculiar modified form (figs. 38, 39) in which the distal end is bent downward, forming a kind of hood. Length, 3.6 mm.

Two specimens, both females, Kartabo, Bartica District, British Guiana, September 9, 1920 (No. 321).

Atelura cucullata occurred with *Cornitermes pugnax* n. sp., which builds a nest close to the ground or under the ground, the nest being rather loosely constructed.

Nicoletia emersoni sp. nov.

(Plate XXII, figs. 40 to 48). (Plate XXIII, figs. 49, 50).

Pale yellow; appendages white. Campodeiform (fig. 40), five times as long as broad; body parallel-sided, the last four abdominal segments becoming successively narrower. Thorax not broader than abdomen, from two-fifths to two-thirds as long as the latter. Head much longer than prothorax, with a median dorsal pentagonal sclerite (fig. 40). Eyes absent. Antennae long (incomplete in the specimens examined); first six segments (fig. 41) in relative lengths as 28:20:9:5:8:10; first segment large, subovate; second cylindrical. In one specimen the first 12 segments are simple (fig. 41) and each of

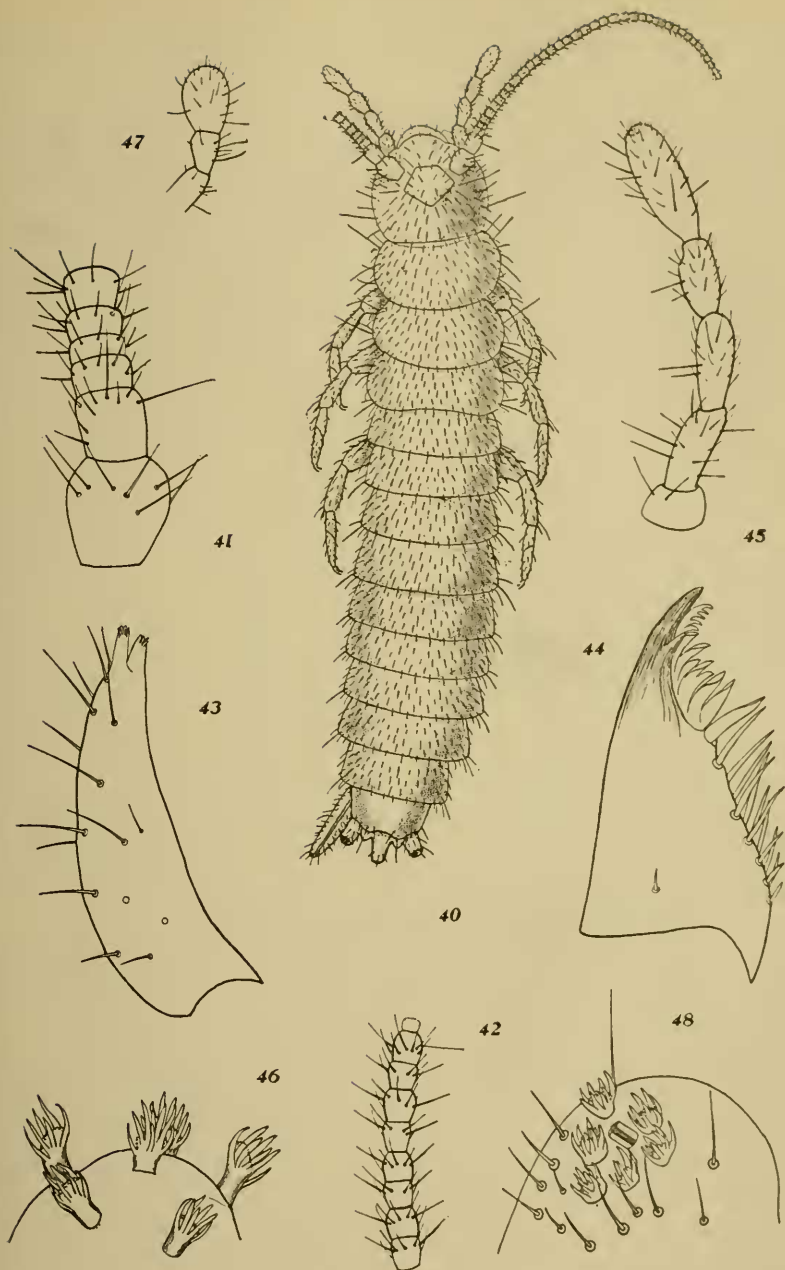


Plate XXII.

NICOLETTA EMERSONI SP. NOV.

40, dorsal aspect, X 25; 41, base of antenna, X 100; 42, distal segments of antenna, each primary segment being divided into two subsegments, X 100; 43, galea of right maxilla, ventral aspect, X 250; 44, lacinia of right maxilla, ventral aspect, X 250; 45, maxillary palpus, X 86; 46, apical sense organs of left maxillary palpus, X 677; 47, end of labial palpus, X 86; 48, subapical sense organs of left labial palpus, X 505.

the remaining 14 segments is divided into two equal sub-segments (fig. 42), making apparently 40 segments in all; total number of segments unknown; second segment in male without a secondary sexual process. Galea maxilla (fig. 43) with a pair of terminal papillae. Lacinia (fig. 44) with large apical tooth, small inner subapical tooth, and an inner subapical comb, with series of inner teeth and setae as in fig. 44. Maxillary palpus with segments as in fig. 45; last segment sub-elliptical, three times as long as broad, with six apical branched sensory papillae (fig. 46), each consisting of a stalk bearing curving branches that surround a central sensory lobe. Last segment of labial palpus (fig. 47) clavate, two-thirds as broad as long, with a group of six distal sensory papillae (fig. 48) like those of the maxillary palpus except in being sessile. Tenth abdominal tergite in both sexes with a shallow median rounded emargination and rounded posterior lobes (fig. 49). Cerci and pseudocercus of unknown length (being broken off). Styli eight pairs, on the second to ninth abdominal segments, respectively; with accompanying eversible vesicles (fig. 50) except on the ninth segment. Ovipositor in form and length as in fig. 40. Parameres of male finger-like in form, each with a terminal seta (fig. 50). Clothing of dense short setae of irregular lengths, with long setae on the head, lateral borders of the thoracic segments, and postero-lateral angles of the abdominal segments. Length, 4 mm.

Nicoletia emersoni approaches *N. neotropicalis* Silvestri ('01b), from Argentine, Paraguay and Brazil, but differs from that species in having wider abdominal segments, and the pseudocercus of the male not narrower than the cerci, as well as in other respects. The first three segments of the maxillary palpus lack the spines shown in the figure by Escherich ('04) and the terminal sensory papillae of the maxillary palpus differ in form in the two species.

Two specimens, one of each sex, Penal Settlement, Bartica, March 24, 1919. Not termitophilous.

I take pleasure in naming this species after Mr. Alfred Emerson.

Borecus gen. nov.

Eyes and postantennal organs absent. Antennae short, but longer than the head, four-segmented, without subsegments or rings. Mouth parts biting. Prothorax reduced but not rudimentary. Mesonotum large but not produced over the base of the head. Fourth abdominal segment much longer than the third. Tibiotarsi two-segmented. Unguis with a pair of large inner basal lobes and a pair of smaller outer basal lobes, or pseudonychia. Unguiculus well developed, with a strong outer basal lobe. One tenent hair. Furcula strongly developed, appended apparently to the fifth abdominal segment. Manubrium longer than dentes. Dentes unsegmented, smooth dorsally, without crenulations or rings, and without chitinous hooks, but with two dorsal longitudinal series of large feather-like setae, and clothed ventrally with scales. Mucrones strongly elongate, non-lamellate, tomocerine in type but without the basal tooth, with a large apical tooth, a large subapical dorsal tooth, and a varying number of smaller dorsal teeth between the subapical tooth and the base of the mucro. Dens with an apical pair of long hyaline scales extending under the mucro. Clothing of both scales and setae, the latter mostly fringed and frequently clavate.

This new genus falls near the peculiar genus *Oncopodura*, described from the species *hamata*, from the Crimea, by Carl and Lebedinsky ('05), and represented also by a second species, *crassicornis* Shoebbotham ('11) from England and Poland (Stach '21). *Oncopodura* is unlike *Borecus* in having the following differentiating characters: Postantennal organs present or absent. Prothorax rudimentary. Fourth abdominal segment slightly longer than the third. Unguis simple, without inner teeth, without pseudonychia, and without large inner basal lamellae, though narrow pointed lateral lamellae may or may not be present. Unguiculus simple, without teeth or lobes. Tenent hairs absent immediately above the unguis, but a strong clavate hair projects from the tibiotarsus about midway from the base to the apex on the second pair of legs only. Dentes with chitinous hooks, with slender fringed hairs dorsally, but

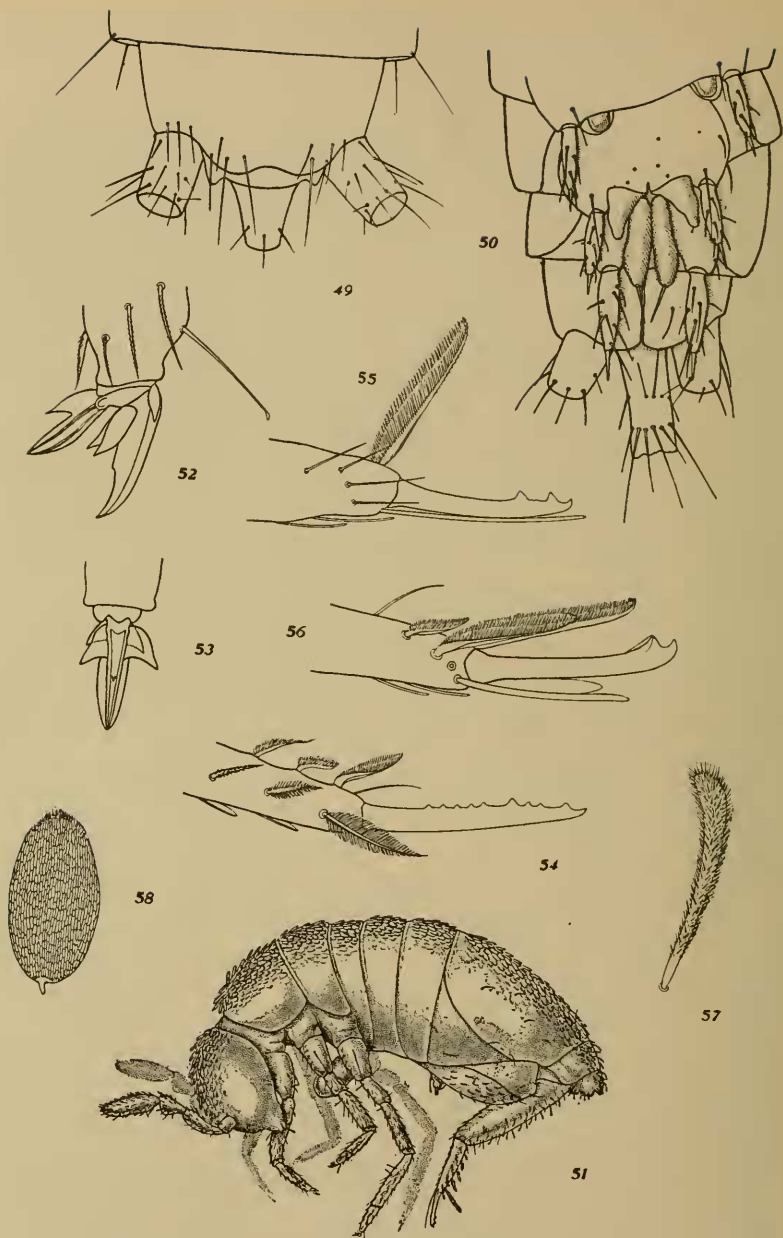


Plate XXIII.

NICOLETIA EMERSONI SP. NOV. *BOREBUS PINNATUS* GEN. ET SP. NOV.

NICOLETIA EMERSONI.—49, dorsal aspect of tenth urotergite of female, X 70; 50, ventral aspect of male to show parameres and last three pairs of styli, X 88.

BOREBUS PINNATUS.—51, lateral aspect, X 68; 52, right hind foot, X 632; 53, concave aspect of left hind unguis, X 632; 54, left aspect of right mucro and end of dens, X 380; 55, left aspect of left mucro and end of dens, X 588; 56, left aspect of left mucro and end of dens, X 404; 57, dorsal clavate fringed seta from base of dens, X 1008; 58, typical scale from dorsum, X 648.

without broad pinnate setae. Mucro with a well developed hyaline membrane, or lamella.

The genus *Borecus* may be placed with *Oncopodura* in the subfamily Oncopodurinae of the family Entomobryidae. The affinities of *Oncopodura* lie with *Cyphoderus*, as Stach ('21) has pointed out.

***Borecus pinnatus* gen. et sp. nov.**

(Plate XXIII, figs. 51 to 58).

White throughout (fig. 51). Eyes and postantennal organs absent. Antennae longer than the head, varying from slightly longer (in small specimens) up to 1.5 times as long as the head (large specimens); four-segmented, without subsegments; antennal segments varying greatly in relative lengths, but with third segment always much shorter than the second or the fourth; first segment cylindrical; second clavate, becoming subcylindrical with age; third clavate; fourth subconical, elongating with age; third segment with a subapical pair of elliptico-cylindrical sensory pegs lying exposed, not covered by an integumentary fold; fourth segment distally with short curving sensory setae; antennal clothing of abundant short minutely fringed setae, with occasional outstanding simple setae. Mouth parts biting. Prothorax reduced. Mesonotum rounded anteriorly, covering the prothorax, the latter abnormally exposed in fig. 51, but not projecting over the base of the head. Metanotum two-thirds as long as mesonotum. Tibiotarsi with a transverse suture one-third from the apex; femora with a transverse suture near the apex; these sutures not always evident, however. Legs clothed with abundant fringed setae, with one (occasionally two) long stout outstanding fringed setae on each segment of each leg. Unguis (figs. 52, 53) straight basally, curving apically, with a pair of large inner basal sublanceolate lobes extending half the length of the claw; with a pair of smaller basal lateral lanceolate lobes (pseudonychia); and with an obscure tooth (doubled?) or angle near the middle of the inner margin. Unguiculus (fig. 52) large, extending three-fourths as far as the unguis, with a large basal subovate acuminate outer lobe. Hind claws the

largest. Tenent hair single, feebly knobbed. Ventral tube with a pair of eversible rounded vesicles. Fourth abdominal segment much longer than the third, varying in relative length but usually from three to five times as long as the latter. Rami of tenaculum quadridentate; corpus with a single ventral seta. Furcula apparently appended to the fifth abdominal segment, attaining the ventral tube in the larger specimens, but not in the smaller. Manubrium elongate, scarcely tapering; dorsally with many setae, either simple, or clavate and fringed; ventrally with scales. Dentes two-thirds as long as manubrium, slightly tapering, one-segmented, smooth dorsally, without crenulations or rings, with two dorsal rows of large pinnae, or feather-like setae (figs. 54-56) which, proceeding posteriorly, become successively larger. The setae of the outer series are 5-10 in number (according to age), the proximal one, two, or more setae being relatively simple and the remainder modified. The setae of the inner series are 4-7, the proximal one or two being simple, and the last of the pinnate setae (subapical) being exceptionally long (figs. 55, 56), sometimes a little longer than the mucro. At the base of the dens dorsally is a stout clavate erect fringed seta (fig. 57). Under the mucro are two long, narrowly elliptical, hyaline, minutely striated scales (figs. 55, 56), one of which may extend beyond the mucro; these scales arising near the apex of the dens. Each dens bears a lateral row of 4-15 simple or feebly fringed setae; ventrally the dentes are clothed with scales. Mucrones (figs. 54-56) one-half to three-fifths as long as the dentes, slender and tapering in dorsal aspect, in form much like those of *Tomocerus*, with a large apical tooth, usually hooked, and a dorsal subapical tooth subequal to the first. Between the base of the mucro and the subapical tooth is a dorsal row of small intermediate teeth (fig. 54), one of which is larger than the others. These intermediate teeth may, however, be absent, as in fig. 56, and when present vary in number from 1 to 11. Mucronal lamellae are absent, excepting in some specimens a minute lamella extending forward from the antepical tooth as in fig. 56. The scales that clothe the head and body dorsally differ in size and vary in form from elliptical to oval, ovate or roundish, but are commonly elliptical, as in fig. 58. Fringed setae occur on

the head anteriorly, on the fourth abdominal segment posteriorly, and on the fifth and sixth abdominal segments, many of the setae on the genital and anal segments being strongly clavate. Length of specimens, 0.54 mm. to 1 mm.

This species varies considerably, some of the variation being correlated with the age of the individual (as indicated by its size), and some being independent of age. The dorsal setae of the dentes increase in number with the age of the individual, and more of them become pinnately modified. In several small specimens, 0.54 mm. to 0.87 mm. in length, the dorsal intermediate teeth of the mucrones were absent; in one individual, 0.9 mm. in length, there was one of these teeth on each mucro; in five specimens, all 1 mm. long, the number of intermediate teeth varied from one to eleven.

Fifteen specimens, Kartabo, Bartica District, British Guiana, June 21, 30, July 13, 30. (Field Nos. 57, 87, 92, 101.)

Hosts.—*Rhinotermes* (*R.*) *marginalis* (*L.*), *Nasutitermes* (*N.*) *costalis* (*Holmgren*), *Nasutitermes* (*N.*) *octopolis* *Banks*, *Nasutitermes* (*N.*) *acajutlae* (*Holmgren*).

Boreus pinnatus was with four species of termites: *Nasutitermes* (*N.*) *octopolis* *Banks*, *costalis* (*Holmgren*), *acajutlae* (*Holmgren*); *Rhinotermes* (*R.*) *marginalis* (*Linné*). All but the last of these species build conspicuous, well formed nests above ground.

Mr. Emerson reports that this collembolan was found very often in large numbers in nests, and says, "I think it very likely that the same species is found outside of termite nests, but found one striking illustration of their true association with the termites. One morning I found an entire termite colony of the species *Nasutitermes* (*N.*) *costalis* (*Holmgren*) migrating over a sandy stretch of ground. The king and queen termites in addition to the workers and soldiers were all going along in a long file from a clump of bamboos to our dwelling. In addition to numerous other guests found among the termites, springtails were also running along the trail and were undoubtedly migrating with the termite colony. To my mind, this is a

conclusive proof that the springtails have a distinct liking for life among the termites. They run rapidly about among the termites in the nests and I have never observed any hostile action toward them on the part of the termites. They are also pantermitophilous, as illustrated by the different host species, and in the case where they were found associated with *Rhino-termes (R.) marginalis* (Linné) there was no particular nest, the termite colony being very small. It therefore seems to me that the association of the Collembola with the termites is rather more loose than is the case with the species of *Atelura* and most other synoeketes, and it is highly probable that they are not entirely dependent upon the termites for their existence."

BIBLIOGRAPHY

CARL, J., AND LEBEDINSKY, J.

1905. Materialien zur Höhlenfauna der Krim. II. Aufsatz. Ein neuer Typus von Höhlenapterygoten. Zool. Anz., vol. 28, pp. 562-565, figs. 1-6.

ESCHERICH, K.

1904. Das System der Lepismatiden. Zoologica, Heft 43, 164 pp., 4 pls., 67 figs.

JANET, C.

- 1896a. Sur les rapports des Lépismides myrmécophiles avec les Fourmis. Comptes rend. Séances Acad. Sc., vol. 122, pp. 799-802, 1 fig.
 1896b. Sur les Lepismina polypoda, Grassi, et sur ses rapports avec les Fourmis. Bull. Soc. Ent. France, pp. 131-138.

SHOEBOTHAM, J. W.

1911. Some Records of Collembola New to England, with Description of a New Species of Oncopodura. Ann. Mag. Nat. Hist., ser. 8, vol. 8, pp. 32-39, pl. 3.

SILVESTRI, F.

- 1901a. Descrizione di nuovi Termitofili e relazioni di essi con gli ospiti. Boll. Mus. Zool. Anat. comp. Univ. Torino, vol. 16, pp. 1-24.
 1901b. Materiali per lo Studio dei Tisanuri. Bull. Soc. Ent. Ital. vol. 33, pp. 204-249, figs. 1-48.

STACH, J.

1921. Vorarbeiten zur Apterygoten-Fauna Polens. Teil II. Apterygoten aus den Pieniny. Bull. Acad. Polonaise Sc. Lett. (1919), pp. 133-233, pls. 5-7.